REMARKS

Reconsideration and allowance of the above-identified application, as currently amended, is respectfully requested.

Amendments were effected in independent claims 1 and 2 that are of a clarifying nature. In particular, the structural composition of the set forth metallic layer and the manner of the connections of the first and second precious metal layers according to independent claim 1 were clarified. Similar such clarification was effected with regard to the featured aspects set forth in independent claim 2. In claim 1, also, the recitation pertaining to the "semiconductor element" was deleted as being unnecessary. Since any such semiconductor element would also be associated with the set forth semiconductor substrate, the expression "a semiconductor element..." was accordingly deleted from claim 1.

Other revisions were also effected in the claims that are, generally, of a minor formal nature. For example, the recitations "a second metallic member connected to such second electrode; wherein said second electrode is connected to such second metallic member via a metallic layer containing precious metal," was accordingly simplified to the set forth expression a second metallic member connected to said second electrode via a metallic layer containing precious metal.

In claim 2, further, the original inferentially recited "chip electrode" was represented as a positive limitation in connection with the expression an electrode provided on said semiconductor chip. Also, the expression "is composed of any of..." was replaced with a typically more readily used expression. The last subparagraph of independent claim 2 was also editorially clarified.

In dependent claims 6 and 8, the term "wherein" was appropriately inserted at the start of the respective set forth expressions therein, to thereby conform to the format employed in the other dependent claims.

The invention according to claim 1, as currently amended, is a semiconductor device in which a key aspect thereof concerns the structural composition of the metallic layer which contains precious metal and which is used in the connection of the second metallic member to the second electrode. Namely, a key aspect according to claim 1 is:

> "wherein said metallic layer is a composite metal layer comprised of a first precious metal layer metallically bonded to said second electrode and a second precious metal layer metallically bonded to said second metallic member, said first precious metal layer being adhered to said second precious metal layer by compression bonding."

With regard to independent claim 2, a featured aspect of the semiconductor device set forth therein is that:

> "said electrode is metallically bonded to said plated precious metal film provided on said metallic member via Au bumps, said Au bumps being adhered to said plated precious metal film by compression bonding."

In claim 1 the first and second precious metal layers, which are metallically bonded to the second electrode and the second metallic member, respectively, are adhered by compression bonding. Likewise, in claim 2, which calls for the electrode to be metallic bonded to the plated precious metal film provided on the metallic member via Au bumps, the two precious metals (e.g., the plated precious metal film and the Au bumps) are adhered by compression bonding.

It is submitted, such compression bonding between two precious metals promotes high thermal conductivity and a high reliability of the semiconductor device.

The high thermal conductivity at the connection of the electrode and the metallic member such as at the rear plain of the semiconductor substrate leads to a semiconductor device with improved resistance to heat. It is submitted, the invention according to claims 1 and 2, and, further, according to dependent claims 4-8 define over the combined teachings of Kasem, et al. (U.S. Patent No. 6,249,041), Nakamura, et al. (JP 1-266752) and Osawa, et al. (U.S. Patent No. 6,077,727), as applied in the standing final rejection. Therefore, insofar as presently applicable, this rejection is traversed and reconsideration and withdrawal of the same is respectfully requested.

It is submitted, Kasem, et al. neither described nor suggested the adhering of two precious metals involved in the connection of an electrode and a metallic member in connection with a semiconductor device according to claims 1+ and 2. More particularly, Kasem, et al. neither disclosed nor suggested adhering of two precious metals by compression bonding in the connection of an electrode and a metallic member with regard to a semiconductor device as that set forth in claims 1+ and 2.

Kasem, et al.'s MOSFET package construction scheme features a bonding scheme in which lead frames are bonded to a semiconductor chip via an electrically conductive adhesive. This can be seen with regard to Figs. 1 and 2 in which both the source lead assembly 18 as well as the gate lead assembly 20 form an electrically connection with the source and gate of the MOSFET, respectively, via an adhesive layer 19, which is electrically conducting. Likewise, the drain lead assembly 22 is also adhered to the drain of the MOSFET via the electrically conductive adhesive layer 23. Examples of the types of electrically conductive adhesive material that may be used are given in column 4, lines 11 – 16, in Kasem,

et al. The lead assembly of the power MOSFET according to Kasem, et al. is formed from a sheet of metal such as copper (Cu) alloy or aluminum (e.g., column 3, lines 14-19, and Figs. 1 – 2; column 5, lines 41 – 45, and Figs. 3A – 3B; column 6, lines 59 – 63, and Figs. 4A and 4B, etc.).

It is also noted that the materials used in the formation of the source electrode as well as the gate electrode, according to Kasem, et al. does not involve a precious metal. For example, regarding Kasem, et al.'s embodiments shown in Figs. 3A and 3B, the source contact area 44 and the gate contact area 46 on the top side of the chip 42 are reach covered with metallization layer formed from a conductive metal such as aluminum (Al), nickel (Ni) or copper (Cu). A drain contact area is also covered with a metallization layer (column 5, lines 24 – 31, and Figs. 3A and 3B; column 6, lines 44 – 49, and Figs. 4A and 4B, etc.). It is apparent, therefore, that neither the leads nor the MOSFET electrodes of Kasem, et al. contain or are plated with a precious metal. In other words, the connection effected between the lead frame and an electrode does not involve the adhering of two precious metals nor, for that matter, the adhering of two precious metals by compression bonding. In Kasem, et al., since none of the lead assemblies nor the metallization layers associated with the source, gate and drain electrodes call for precious metals, a connection between two precious metals does not exist in the connection involving the leads and the MOSFET electrodes through the electrically conductive adhesive layer. According to Kasem, et al.'s teachings, only the electrically conductive adhesive layer may use a precious metal material such as in the formation of, for example, silver-filled epoxy.

Nakumara, et al. disclosed a scheme in which thermal compression bonding is implemented between an aluminum (Al) electrode and copper (Cu) lead through a gold (Au) bump. In other words, the connection taught by Nakamura, et al. involves

two connections both of which are between a non-precious metal and a precious metal but not between two precious metals. For example, Nakamura, et al. taught a construction which features a connection between Al an Au or connection between Au and Cu. This can be seen with regard to Fig. 1 of Nakamura, et al. involving a connection between the electrode 2 (Al pad) and the metal grain Au bump 3 and the connection between the Au bump 3 and the lead (Cu foil) 4. Herein, also, the connection between the pad (electrode) 2 and the lead 4, according to Nakamura, et al., does not involve adhering of two precious metals in the manner as that presently set forth in claims 1+ and 2.

Osawa, et al., it is also submitted, neither disclosed nor suggested the connection of two precious metals. Namely, Osawa, et al. employed an ultrasonic bonding method between the Au side of a thin lead (having upper and lower Au layers and a Cu layer) and electrode pads of the semiconductor chip. For example, with regard to the showings in Figs. 3 – 4 in Osawa, et al., the lead frame 23 consists of an upper Au layer 23c, a middle Cu layer 23b and a lower Au layer 23a. That is, the three metal layers 23a, 23b and 23c of the composite lead 23 forms a connection between the lower gold layer 23a and the copper layer 23b as well as the connection between the copper layer 23b and the upper gold layer 23c. It is emphasized, also, that the bonding technique employed by Osawa, et al. is an ultrasonic bonding method and not a compression method. It is submitted, therefore, a connection between two precious metals does not exist in the connection between the lead frame and the pad 2 of Osawa, et al.

As was shown hereinabove, none of the cited references disclosed or suggested adhering two precious metals or, for that matter, adhering two precious metals by compression bonding involved in the connection of a metallic member and

a second electrode of a semiconductor device as that presently set forth according to independent claim 1 and further according to the corresponding dependent claims thereof as well as with regard to independent claim 2. Regarding the various embodiments of Osawa, et al., all of the fine leads such as 13 and 23 are composite film layers that are joined by using ultrasonic bonding and not compression bonding. As such the respective gold layers become joined to opposing sides of the intervening copper layer and the lower gold layer is joined to the electro pads of the semiconductor chip. Also, according to Osawa, et al., the joining layers such as nickel layer 33b may also be inserted between gold and copper layers such as shown with regard to Figs. 6 – 7 (column 6, lines 39 – 44).

It is submitted, for at least the above reasons, the invention according to claims 1, 2 and 4 – 8 could not have been rendered obvious as that alleged in the outstanding rejection, especially, when considering the substantial differences in the disclosures of three references.

Therefore, in view of the above-made amendments together with these accompanying remarks, acceptance/formal entry of this Amendment as well as favorable action on pending claims 1, 2, 4 – 8 and an early formal notification of allowability of the above-identified application is respectfully requested.

If the Examiner deems that questions and/or issues still remain which would prevent the present application from being allowed at the present time, he/she is invited to telephone the undersigned representative, at the telephone number indicated below, so that either a telephone or personal interview may be arranged at the Examiner's convenience in order to discuss the same and hopefully resolve any remaining questions/issues present.

Docket No.: 503.38097CX1

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Antonelli, Terry, Stout & Kraus, LLP Deposit Account No. 01-2135 (Docket No. 503.38097CX1), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By _____
Larry N. Anagnos
Registration No. 32,392

LNA/gjb
1300 N. Seventeenth Street
Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666